



THE UNIVERSITY *of* EDINBURGH

Edinburgh Research Explorer

Building consensus

Citation for published version:

Galey-Horn, S, Reckhow, S, Ferrare, JJ & Jasny, L 2020, 'Building consensus: Idea brokerage in teacher policy networks', *American Educational Research Journal*, vol. 57, no. 2, pp. 872-905.
<https://doi.org/10.3102/0002831219872738>

Digital Object Identifier (DOI):

[10.3102/0002831219872738](https://doi.org/10.3102/0002831219872738)

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Peer reviewed version

Published In:

American Educational Research Journal

General rights

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.



American Educational Research Journal

Building consensus: Idea brokerage in teacher policy networks

Journal:	<i>American Educational Research Journal</i>
Manuscript ID	AERJ-18-0015.R2
Manuscript Type:	Original Manuscript
Abstract:	<p>We show how policymakers converged to support similar reforms on a major educational issue: teacher effectiveness. Our study demonstrates the importance of idea brokers—actors that facilitate connections between preferences in policy networks and promote consensus around new policy ideas. Our study is based on analysis of testimony from 200 Congressional hearings from 2001 to 2015. We use discourse network analysis to examine network ties based on policy preferences expressed in hearings. We visualize policy networks, identify brokers, and estimate exponential random graph models (ERGMs) to examine policy changes between the Bush and Obama administrations. We show how idea brokerage is associated with a convergence of policy preferences around teacher effectiveness among a coalition of political actors.</p>

SCHOLARONE™
Manuscripts

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Abstract

We show how policymakers converged to support similar reforms on a major educational issue: teacher effectiveness. Our study demonstrates the importance of idea brokers—actors that facilitate connections between preferences in policy networks and promote consensus around new policy ideas. Our study is based on analysis of testimony from 200 Congressional hearings from 2001 to 2015. We use discourse network analysis to examine network ties based on policy preferences expressed in hearings. We visualize policy networks, identify brokers, and estimate exponential random graph models (ERGMs) to examine policy changes between the Bush and Obama administrations. We show how idea brokerage is associated with a convergence of policy preferences around teacher effectiveness among a coalition of political actors.

Key Words: Policy Network Analysis, Teacher Effectiveness, Policy Change, Discourse Networks, Advocacy Coalition Framework, Idea Brokers

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Education researchers tend to approach policy analysis retrospectively, paying close attention to outcomes and interests served by the policy change as well as the impacts of policies on schools, teachers, and students. These are, of course, important considerations. However, the emphasis on policy *ex post facto* conceals our understanding of the conditions that create policies in the first place. In the following, we explore the emergence of new policy proposals concerning teacher quality reforms in order to understand how policy actors build ideological consensus in educational policy systems. Although partisan divisions run deep in other policy domains in U.S. politics, in education, policymakers from both political parties have recently supported teacher effectiveness reforms to improve teacher quality (Wolbrecht & Hartney, 2014). Teacher effectiveness policies emphasize efficiency, competition, and academic outputs and include teacher evaluation and merit-based pay. Over the past decade, teacher effectiveness reforms have dominated federal and state policy-making agendas, representing a significant shift in how policymakers, the media, and the public talk and think about public education (Author, 2015a).

The framing of policies in public debate, or the policy discourse, is one way to observe a major policy change. Mehta's (2013) analyses of recent policy changes show how a major rhetorical shift in the direction of test-based accountability propagated the spread of teacher effectiveness policies at the turn of the 21st century. As Mehta explains, even the way policy actors define policy problems can change the very nature of a policy debate. Other scholars also attribute recent federal policy changes to ideological shifts and new coalitions of interest groups (DeBray-Pelot, & McGuinn, 2009; McDonnell & Weatherford 2013). Our analysis links these studies of broad idea shifts to the role of specific policy actors—idea brokers. We show how these brokers carry ideas and new problem definitions, providing mechanisms that helped drive Democrats and Republicans to support similar policies to address teacher effectiveness.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Major policy change can be observed in debates among networks of policy actors (Leifeld, 2016). This study uses discourse network analysis (Leifeld, 2013) of testimony from 200 congressional hearings on teacher quality from 2001 to 2015. We analyze how new policy preferences arise and draw support from varied actors over time. Our analysis shows how early iterations of effectiveness reform under the Bush administration, such as school-based accountability and merit-based teacher compensation, helped give rise to the widespread adoption of teacher effectiveness reforms during the Obama administration. We find that idea brokerage is associated with the emerging popularity of particular policy preferences, including teacher accountability. Theoretically, our project advances and tests the concept of an idea broker, building on the social network concept of brokerage (Gould & Fernandez, 1989). We show how idea brokerage in the education policy debate is associated with convergent policy preferences among political actors towards teacher effectiveness. Further, our findings suggest that idea brokers may be more likely to introduce new ideas during a time period when a policy window is open (Kingdon, 1984)—in this case, during a shift in party control of congress and the presidency, from 2007 to 2009.

Our findings have implications for contemporary educational politics and policy-making given the opportunity for state-level policy change under the Every Student Succeeds Act (ESSA) legislation. The decentralized conditions created by ESSA suggest that idea brokers will play an increasingly crucial role in state and local-level policymaking during the coming years. In each state, there is an opportunity for renewed debates over policies to address teacher quality. While some will promote teacher effectiveness policies, others will support policy ideas that focus on teacher collaboration, teacher compensation and benefits, and the role of teacher unions. Idea brokers will have an interest in converging policy preferences around their policy core

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

beliefs. We recommend that researchers studying educational policy change in the coming years attend to the influence of idea-based policy networks in state and local policymaking. Such analyses can help stakeholders identify idea brokers and anticipate moments of policy change.

Policy Context: From School-based Accountability to Teacher Effectiveness Reforms

For the past fifteen years, federal and state policymakers have dramatically expanded teacher effectiveness reforms. Prior to the passage of No Child Left Behind (NCLB), Republicans typically argued that education should be left to the states, while Democrats supported major federal programs to advance equity and increase funding, including Title I of the Elementary and Secondary Education Act. However, during the administrations of President George W. Bush and President Barack Obama, both major parties supported accountability reforms, including teacher effectiveness policies. The adoption of NCLB under President Bush codified test-based accountability by formally linking federal funds to educational outputs (McDonnell, 2013). The Obama administration's Race to the Top (RTTT) program, meanwhile, authorized a \$4.35B competitive grant program that encouraged states and districts to develop ambitious educational reform agendas, including comprehensive longitudinal educational data systems to attach student achievement data to individual teachers (American Recovery and Reinvestment Act of 2009).

NCLB was adopted with broad bipartisan support—bringing together a Republican administration and Democratic stalwarts, like Senator Ted Kennedy. Under NCLB, schools would be held accountable for student achievement outcomes, including gaps in such outcomes between subgroups of students. Among other things, NCLB created sanctions for schools and districts that failed to achieve “adequate yearly progress” based on student test performance

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

(McDonnell, 2013). This legislation built upon a redefinition of educational issues advanced by both major political parties, highlighting excellence and accountability as mechanisms to address education issues, rather than emphasizing funding (Wolbrecht & Hartney, 2014; Mehta, 2013).

While NCLB focused on school-level accountability, the legislation attempted to address the quality of teachers entering the profession by pushing districts to move towards employing “highly qualified” teachers. However, the definition of a highly qualified teacher focused on subject matter competency and other professional inputs rather than student achievement. When it became apparent that the lofty goals of NCLB to reach 100 percent academic proficiency by 2014 were unattainable, the Department of Education granted waivers to 43 states that significantly relaxed many of NCLB’s provisions (U.S. Department of Education, 2014). Despite these waivers, Obama’s Race to the Top (RTTT) program maintained the general course set by the law, while expanding federal and state attention to teacher effectiveness. Teacher effectiveness policies aimed to assess the impact of individual teachers on student test score growth, potentially narrowing the scope of performance assessment for educators.

In contrast to NCLB, RTTT focused more on incentives and capacity-building – using the “carrot” rather than the “stick” to motivate reform efforts (McGuinn, 2012; Mehta & Teles, 2012). RTTT, for example, focused on training and retention of effective educators and rewarding educators for turning around the lowest-performing schools and districts. RTTT shifted the focus to outcomes, specifically student achievement as a primary indicator of teacher effectiveness. Over the past decade, and largely in response to RTTT, three-fourths of the states have adopted teacher evaluation systems that incorporate student growth measures, as well as statewide data systems to keep track of student- and teacher-level data (McGuinn, 2012). Many

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

states and districts now link teacher evaluations to high stakes personnel decisions, including tenure, performance pay, and firing (Foderaro, 2010).

In some respects, the rapid expansion of teacher effectiveness policies is surprising. First, concerns about the unintended negative consequences of test-based accountability resulting from NCLB (such as an overemphasis on tested subjects) were already circulating during the latter years of the Bush administration (Booher-Jennings, 2005; Fuller et al., 2007; Hamilton et al., 2007). Second, the emphasis on teacher effectiveness is a very direct concern to a major Democratic Party constituency: teachers' unions. Elementary and secondary teachers are one of the largest occupational groups in the country and well known for their high levels of engagement in politics—policies that directly alter occupational practices and protections for teachers are unlikely to advance without a mobilized response from teachers (Hartney & Flavin, 2011). At the state level, teacher union strength is associated with a lower likelihood of a state adopting performance pay policies (Finger, 2018). In a few instances, teachers' unions have cooperated with policymakers to enact teacher effectiveness policies, particularly at the state and local levels. However, as teacher evaluation policies have evolved, unions have generally opposed accountability reforms and other policies that use test score metrics to evaluate educational quality.

One factor that may undermine the influence of teachers' unions in educational politics is the emergence of powerful and well-connected advocacy organizations that mediate between policymakers and policy implementation systems, or intermediary organizations. Studies show, for example, that alternative certification programs have spread rapidly across urban school districts with support from federal grant money and generous private foundation funding (Author, 2014). More broadly, recent research reveals the centrality of intermediary

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

organizations in research-use networks that inform educational policymaking (Scott & Jabbar, 2014). Researchers have found that decision-makers are frequently ill-equipped to interpret complex evidence and rely on intermediary organizations to synthesize and interpret policy-oriented research (Nelson et al., 2009). Intermediaries can use this powerful brokering position, between policymakers and the public, to represent evidence in ways that build support for particular policies (Jabbar et al., 2014). In the following analysis, we explore exactly how and when ideas involving teacher effectiveness emerged in the national policy debate.

Conceptual Framework: Networks of Actors and Ideas

Educational policy is a complex field—crowded with competing actors, new sources of data and analysis, and ideological perspectives. To grapple with this complexity, scholars of education policy have begun to turn to social network theory. This approach to examining education policy assumes that, in addition to formal bureaucratic structures, education policy outcomes are shaped through informal relationships between policy actors (Daly, 2010; Rhodes, 2006). To date, much of the work utilizing social network theory in education policy has focused on implementation processes, especially as it relates to teacher and leadership networks (e.g., Coburn & Russell, 2008; Daly, 2010; Daly & Finnigan, 2011; Daly, Moolenaar, Bolivar, & Burke, P., 2010; Jabbar, 2015; Keuning, Van Geel, Visscher, Fox, & Moolenaar, 2016; Penuel, Riel, Krause, & Frank, 2009; Siciliano, 2016). Increasingly, however, researchers who study the policy-making process are using social network theory to examine how policy-makers advance new ideas through formal and informal structures (Leifeld, 2016).

Particularly at the federal level, policymakers often make decisions in an information-rich and complex environment, but because of cognitive and institutional limitations they cannot

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

devote attention to many policy issues at once – a phenomenon known as “serial processing,” or “selective attention processing” (Baumgartner & Jones, 2012). Many issues may compete for policymakers’ attention during a “policy window”—a limited period of time when many actors see an opportunity for policy change—for instance, during the transition to a new presidential administration or the reauthorization of major legislation (Baumgartner & Jones, 1993). To understand how policymakers process information in a crowded and complex environment, we draw on policy network theory; this approach begins with the premise that policymakers are both embedded in informal policy networks (Rhodes, 2006) and participate in formal institutional venues to acquire policy information and sort through it. As members of policy networks, they rely on network ties to transmit and legitimize policy ideas and solutions, shaping policy outputs and outcomes, while also relying on institutional rules and norms to guide their decision-making. Thus, actors gather informational signals from the policy environment, which is institutionally and epistemologically bounded by their existing policy beliefs.

Congressional hearings are an important formal venue for communicating policy information, and information provided in congressional testimony about policy effectiveness is positively associated with proposal enactment (Burstein & Hirsh, 2007). Trusted signals about policy ideas and new information are likely to come from actors who policymakers agreed with in the past (Bertelli & Wenger, 2009). Furthermore, actors delivering testimony could strategically position themselves to advance new ideas if they can provide information that is relevant and agreeable to members of both political parties—in other words, by acting as brokers (Heaney, 2006). Actors who deliver testimony in hearings have the opportunity to provide valuable information that policymakers could act upon and advance in the future; but the

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

receptiveness of policymakers to new information is likely to depend upon their existing preferences and prior agreement with organizations participating in the hearing.

We operationalize the relationships between organizations and policy ideas with discourse network analysis. By combining social network analysis and content analysis, discourse network analysis provides a way to assess actor relationships through policy beliefs. Discourse network analysis is distinct from critical discourse analysis, which focuses on qualitative coding of communications between actors (Perna et al. 2019). Discourse network analysis examines on the “discursive” layer of politics where political debates occur (Leifeld, 2013). A discourse network is constructed by analyzing actors’ attitudes expressed in a public arena (e.g. national media, congressional hearings) and creating ties between actors based on shared views (Leifeld, 2013). For example, two actors who publicly state that teacher quality should be assessed with value-added models would share an affiliation in a discourse network.

As Leifeld observes, in prior studies of policy coalitions, “the actual processes of policy learning and policy change largely remain a black box” (2013, p. 171). Discourse network analysis provides a technique to unlock this black box by examining the emergence of beliefs within a network and the relationships that develop around shared beliefs and policy preferences. These networks can be analyzed as two-mode: linking actors through shared policy preferences; or as one-mode: directly linking actors who share policy preferences. Moreover, by gathering stated preferences from public debate over time, it is possible to analyze discourse networks longitudinally.

Brokers of Ideas Within Advocacy Coalitions

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Policy ideas and preferences can change over time—new ideas emerge for addressing policy challenges, and actors adopt new sets of policy preferences. Our analysis directly addresses this dynamic process. We apply the concept of brokers to analyze the emergence of new ideas that link actors. Brokers are actors that have strategic capacity due to their position in the network (Burt, 2004; Gould & Fernandez, 1989; Obstfeld, 2005; Heaney, 2006). Brokers occupy positions in a network that can provide connections between other components of the network that would not otherwise share a direct connection. While brokers are often understood as actors who are strategically advantaged by their position between disconnected alters (i.e. structural holes, Burt, 1982), here we understand the process of brokerage to include instances in which actors serve as a conduit to relay information to consolidate distinct sets of ideas (Obstfeld, Borgatti & Davis, 2014). Brokerage can occur along more than one mode in network—not only based on structural ties between individuals, but also through relationships between different ideas. Applications of two-mode brokerage enable the analysis of links between one set of nodes, such as policy actors, and another set of nodes, such as ideas.

In this study, we focus on policy idea brokers, or more simply “idea brokers”; these are actors who bridge across policy preferences, establishing and strengthening policy consensus. Idea brokering is distinct from traditional definitions of brokering because it focuses on the role actors play in joining together sets of ideas. Instead of emphasizing how brokers close structural gaps between actors, idea brokers consolidate related policies over time to create a coherent agenda around shared policy beliefs. Important work on these issues has emerged from Sabatier (1988) who developed the Advocacy Coalition Framework (ACF) theory of the policy process. As Sabatier explains, he developed the framework to analyze “the manner in which elites from different advocacy coalitions gradually alter their belief systems over time” (1988, p. 130).¹

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Sabatier also wrote about policy brokers between coalitions, and thus their main concern “is with keeping the level of political conflict within acceptable limits,” (1988, p. 141). Idea brokers, rather, operate within coalitions and are concerned with convergence of policy beliefs.

To organize our analysis of policy change and the rise of new ideas, we apply ACF (Sabatier, 1988; Jenkins-Smith et al., 2014) to our concept of idea brokers, which explains how coalitions and network structures change over time and develop consensus around new ideas. A key element of the ACF is its emphasis on the *beliefs* that policy actors hold, which comprise three tiers: *deep core beliefs*, which represent broad normative values; *policy core beliefs*, which are issue specific interpretations of deep core beliefs; and *secondary beliefs*, which concerns “policy preferences” expressed both as general “policy goals”, as well as specific “policy instruments” to achieve those goals.² Figure 1 shows an illustration of the ACF system of beliefs with an example from educational policy over the deep core value of efficiency.

[Insert Figure 1 about here]

We posit that idea brokers play an important role in policy change by building consensus around policy preferences within a policy core belief. Traditional definitions of brokering rely on the concept of structural holes to define whether or not an actor is a broker. In this version, the broker must occupy a position between two disconnected actors (see Figure 2, first panel). However, for two-mode discourse networks of ideas and actors, this definition is too narrow. Discourse networks tend to be very dense because there is a strong tendency for preferential attachment – when an idea is introduced and repeated by a few important actors in the policy discourse, other actors tend to support that idea. In other words, there is a popularity effect. Consequently, the large majority of actors are connected by at least one policy idea making structural holes very rare. In light of this tendency, we use a more expansive definition of

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

brokering, which allows for brokers to exist between actors even when there is already a connection between them. Rather than looking for structural holes, alternative approaches for the empirical observation of brokering can focus on behavior, other structural statistics, or both.

Brokering as a kind of behavioral orientation can be characterized as a social process (for an overview, see Obstfeld, Borgatti & Davis, 2014). In structural hole theory, brokering activity is limited to intermediaries that facilitate access to social resources between disparate parties. Moving beyond the ‘intermediary’ definition, brokering can concern a broad range of social activity. According to Obstfeld (2005), for example, brokers can facilitate knowledge transfer, cultivate conflict, or coordinate new collaborative action between two partners. In this case, the broker is “simply one of the parties” in a triad of three or more actors (Obstfeld et al., 2014, p. 141). Further, Author (2015b) provide categories of brokering across two modes and show how different relational structures across both modes can facilitate collaborative partnerships. Taken together, this multidimensional understanding of brokerage suggests ideas and information flows can serve as the context for practices that brokers may employ in political coalitions within discourse networks. We couple this process-oriented perspective of brokering with the ACF theory of policy change.

An idea broker is uniquely situated to shape the policy discourse by facilitating convergence around a set of policy preferences within a particular policy core belief. According to ACF, preferences associated with policy core beliefs are the “glue that by which coalition members stick together” (Sabatier & Jenkins, 1999, p.134). In this context, we posit that idea brokers facilitate the evolution of ideological coalitions. We further suggest that they do so, not by maintaining the same ideas but, rather, by diversifying the set of policy preferences associated with that policy core belief and promoting those ideas to potential coalition partners. Put

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

differently, they intensify and evolve the debate within a narrow set of ideological parameters; while the policy preferences may change the underlying policy core belief does not. Thus, idea brokers facilitate the ideological mechanisms of change in the direction of policy convergence. In structural terms, idea brokering occurs when there is a tendency for closure between two actors around a particular set of policy preferences. Unlike one-mode brokering (i.e., networks of direct ties between actors), which generally requires three actors, brokering in two-mode networks only requires two actors because there is a second mode– in this case policy ideas.

[Insert Figure 2 about here]

In Figure 2 we illustrate two kinds of network structures associated with idea brokering as a process over time. In Time 1, Actor A has created a brokering chain by locating themselves between two otherwise unconnected preferences. Actor B is also present in the policy debate, but has not yet taken up the same set of preferences as Actor A. As Figure 2 (second panel) illustrates Actor A and Actor B both support Preference 1, but only Actor A supports both Preference 1 and Preference 2. This shows the first kind of idea brokering structure: an open brokering chain. Open brokering chains represent a specific kind of brokering activity – namely, the introduction of a new connection between two ideas. In order to be part of an open brokering chain in a policy network, the actor must be uniquely located between two policy preferences. While other actors may be connected to either of the policy preferences separately only one actor connects both policy preferences. In this sense, open brokering chains mark a period of ideological transition, because other actors are not supporting the same combination of ideas at that time. These kinds of arrangements do not tell us much about whether or not these ideas are actually brokered. In Time 2, however, Actor A has successfully brokered their policy preferences and we see a closed brokering chain involving Actor A and Actor B. A closed

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

brokering chain, or a “4-cycle,” is characterized by two actors sharing the same two preferences. Importantly, we assume that idea brokering occurs within a network of actors that share a policy core belief and are part of the same ideological coalition. Thus, even if Actor A and Actor B never interact directly with each other, Actor B can still recognize Actor A as a trusted source of policy preferences because they are ideological kin.

Hypotheses

We expect idea brokerage to be associated with a change in the policy discourse over time. To observe policy change, we consider how the policy debate over teacher effectiveness evolved over time in terms of policy preference popularity. To observe idea brokering, we examine network motifs that have two policy actors sharing the same two ideas. As mentioned, in network terms, this arrangement of nodes and ties is called a “4-cycle” (see Figure 2, third panel). By observing the popularity of different policy preferences over time alongside the tendency for idea brokerage to occur within particular policy preferences we can show how idea brokers shape the policy debate. We also look at open brokering chains made up of one actor and two otherwise unconnected ideas (see Figure 2, second panel) to see if and when idea brokers appear to introduce new combinations of ideas.

Our main hypothesis concerns the relationship between idea brokering and changes in policy preference popularity over time towards policy convergence. Let’s say, for example, that “teachers must be evaluated and held accountable” and “use teacher evaluations with growth models” are both policy preferences that support teacher evaluation policies. If Actor A and Actor B both mention the same preferences in t , creating a 4-cycle, we expect teacher evaluation policy preferences to gain popularity in $t + 1$. Importantly, teacher evaluation policies would not be popular in t . This pattern of policy change will indicate the presence of idea brokerage. Put

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

differently, when 4-cycles bring together actors to support the same policy preferences in time period t , we expect those preferences to become popular in $t + 1$. We assess the potential impact of idea brokers by examining the popularity of different categories of policy preferences and comparing that with the significance of idea brokering across different time periods between 2001 and 2015.

In relation to our main hypothesis, we expect that brokerage will be most effective during a policy window that coincides with changes in partisan control of the federal government due to the election of a new Congress and a new presidential administration (Kingdon 1984). We anticipate that policymakers are particularly interested in hearing and adopting new policy preferences that are relevant to the fluid political environment that occurs during such a policy window. Brokers will be more likely to introduce new ideas during such a transition.

Additionally, we consider some alternative hypotheses to explain policy change. One alternative is organizational type – particular kinds of actors will be more likely to shape the structure of the policy network and appear in 4-cycles. To assess this possibility, we categorize the actors by the organizational types they represent. We also control for actor activity, preference popularity, and the specificity of policy preferences.

Data and Methods

Data

We gathered data for this study from 200 congressional hearings from 2001 to 2015 that contained substantive content on teacher quality. The hearings were downloaded from the U.S. Government Printing Office (GPO) website. We identified the hearings based on searching for the term “teacher quality” in Congressional hearings on the GPO website. Prior to coding the

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

testimony, we conducted an initial scan of hearings to ensure that the hearings we coded would be relevant to our study. We only excluded hearings that lacked substantive discussion of teacher quality issues, for example, a budget hearing mention of federal funding for “teacher quality programs,” but with no additional discussion of the program themselves. Once we confirmed that a hearing included even a minimal substantive discussion of teacher quality, the hearings were uploaded into the Discourse Network Analyzer software for coding (Leifeld, 2013). We content analyzed the witness testimony and opening statements by members of Congress to construct discourse networks based on shared policy preferences. This step utilized a concept coding procedure that sought to categorize statements into policy preferences at similar levels of granularity (Saldaña, 2012; see online Appendix for full list of codes).

Our coding focused on identifying specific policy preferences related to the policy core belief that teacher quality could be improved by introducing competition and addressing efficiency—an emphasis on economic cost-benefits and optimizing performance (Wood and Theobald 2003). A team of human coders read each hearing and coded statements using a specified set of policy categories (see online appendix). The results of this coding process were validated by a research supervisor. The research supervisor maintained the coherence between individual coders by cross checking the work by each coder. There is no formal measure of intercoder reliability. When there was disagreement between a coder and the supervisor, we discussed the disagreement and sought a consensual solution. All spoken and written testimony provided in the hearings were coded, but the question and answer segments were not.³

Our coding system was designed to identify actors’ support for policy preferences, which included policy goals and, at the highest level of specificity presented in the discourse, policy instruments. Thus, whenever possible, we coded for support for the policy instruments in the

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

codebook. For example, here is a statement from a hearing on May 11, 2007 that we coded for a specific policy instrument related to teacher evaluation: “Use evaluation systems with multiple measures”:

Our own investigation into performance pay issues have led to us to conclude that we need to measure teacher effectiveness in multiple ways. Why? Because there are many influences on student learning. Identifying effective teachers requires evaluating their teacher practices, assessing their performance and examining the different ways they get academic results for students. Only about one in three students can have a value-added test score ascribed to them. Many of the tests are not very good, especially in terms of measuring 21st century learning.

For discourse that was less specific, but still supportive of the policy preferences in our codebook, we coded using the policy goals. The following is an example of a statement linked to the overarching policy goal for teacher evaluation from a hearing on November 8, 2011:

I believe the committee’s bill takes several important steps forward by...incentivizing States and districts to develop rigorous teacher and principal evaluations and support systems.

This statement is supportive of teacher evaluation but does not include any additional specificity on the instruments or policy design of an evaluation system (for example, using value-added models, peer observations, multiple measures, etc.). We also coded statements indicating opposition to specific policy instruments; however, negative statements about instruments are so rare in congressional testimony, we do not include these in our analysis.

In this analysis, we focus on five policy preference categories located within the teacher effectiveness core belief, and developed a policy goal and lists of specific policy instruments associated with each preference category. The five broad policy preference categories include 1) school-level accountability; 2) individual teacher accountability, 3) using performance incentives to motivate educators, 4) effectiveness of teacher preparation and 5) alternative certification. For example, under the main policy goal for teacher accountability, “Teachers must be evaluated and

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

held accountable,” we coded for the policy instrument, “Use evaluation systems with value-added models.” We coded statements that aligned with these preferences accordingly. See Table 1 for a complete list of the codes for each of the preference categories.

[Insert Table 1 about here]

Methods

We applied a multistage, multimodal approach to test our hypotheses. In the first stage, we used the policy preference coding that we completed in the Discourse Network Analyzer software to observe shifts in policy preference popularity over time. We examined patterns of preference popularity to identify key cut-points during our 15-year time period when widely shared ideas shift to new ideas (See Figure 3). Based on our assessment, we focused on the following time periods to create our networks for analysis: 2001-06 for the Bush administration, 2010-15 for the Obama administration, and 2007-09 for the policy window including the shift in party control of Congress and the presidency. We then created three separate two-mode networks using Netdraw (2002) and Adobe Illustrator with policy actors on the first mode and the preferences that they mentioned during that time period on the second mode. Each visualization shows a weighted network of actors by policy preferences, which represents a summary of all the actors that mentioned preferences from our list of codes in Table 1 during each time period.

[Figure 3 about here]

As the descriptive analysis reveals, there is a sudden and substantial increase of activity in 2007 in this policy arena. This activity drops in 2008, which is an election year and increases again slightly in 2009. While we cannot draw any definitive conclusions, based on historical record it appears this policy window opened up in response to a shift in power in the U.S. Congress. In 2007, Democrats took control of Congress making way for major policy change.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Additionally, congressional hearings on the reauthorization of No Child Left Behind began in 2007. As scholars have pointed out (Author, 2015a; DeBray-Pelot & McGuinn, 2009), despite increasing polarization between Republicans and Democrats in recent years, education policy has been one of the major areas of agreement between the two parties. In addition, the time period of the policy window in our analysis also aligns roughly with the period when Race to the Top (RTTT) was developed (in 2009), marking a transition from Bush-era policies to Obama-era policies. Thus, we designated the time periods from 2007-2009 as our policy window.

In the second stage of our analysis, we used exponential random graph models (ERGMs) to determine and compare patterns of behavior across the three time periods (for an overview of the model, see Cranmer and Desmarais [2011]). ERGMs are a powerful tool to model the endogenous configurations as a way of explaining network structure. Like a logistic regression, the dependent variable is a binary variable for the presence or absence of a tie (although weighted versions exist – Kravitsky et al., 2012; Wilson et al., 2017). We apply a two-mode version of an ERG model, which estimates the probability of a tie between an actor and a policy preference. In contrast to traditional regression analysis, however, where the dependent variable is assumed to be only influenced by exogenous variables, ERGM analysis accounts for interdependencies between observations. This is a crucial assumption in the present analysis, as our theoretical framework anticipates that shifts in policy preferences take shape within dynamic networks of actors and ideas. In addition, ERGMs permit specific kinds of interdependence among observations. ERGM analysis usually includes a term for edges, which functions like the intercept, as well as endogenous network terms and exogenous terms for node-level attributes.

Network (endogenous) Terms

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Actor Activity: This term captures the tendency of actors to have multiple policy preferences, using geometrically weighted degree counts for the first mode (actors) in the network (Hunter 2007). This term counts how many actor nodes have one connection to a policy preference, two connections, etc., and places a lower weight on larger numbers of connections using a geometric decay parameter. The closer decay is to zero, the more lower degree nodes are considered relative to higher degree nodes. The assumption is that larger numbers of connections are less prevalent than fewer connections.

Preferential attachment: This term accounts for the popularity effect of ideas using geometrically weighted degree counts for the second mode (preferences) in the network. This term marginally decreases weighting as degree increases using a geometric decay parameter. The closer decay is to zero, the more lower degree nodes are considered relative to higher degree nodes. During the evolution of networks, the more existing ties one node has, the more connections it is likely to accumulate. Conceptually, it is related to the theory of cumulative advantage in science, known as the “Matthew Effect” (Merton, 1968). In this context, it infers that the ability of idea brokers to persuade other actors to support the preferences they promote may increase with the preferences’ centralities in the network.

Node-level (exogenous) Attribute Terms

Organizational Type: This is the organizational type of the actors in the network. This term captures the effects of organizational affiliations on network formation. The actor categories include government actors, legislators (member of the US Congress), intermediaries (think tanks, foundations, businesses, and nonprofits), and traditional actors (teachers, unions, and university actors).

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Policy Preference Category: This is a categorical attribute that applies to the second mode (preferences) in our networks. This will tell us how popular, or unpopular, particular policy preferences are during any given time period.

Policy Goal/Instrument: This categorical attribute applies to the second mode (preferences) in our networks. This acts a control variable for whether or not a policy preference is a policy goal or a policy instrument, according to our coding scheme.

Finally, we tested our main hypothesis by simulating networks from baseline models of our ERGM analysis in order to identify brokering chains in each time period. Sometimes theoretical terms of interest are just not possible to fit within the model. In these cases, we can simulate from an ERG model resulting in networks that have the tendencies fit by the model, and extract counts of the statistic of interest (Mayhew, 1984). We compare these counts from the ERGM simulation to the empirical data and are then able to tell whether, had the term been fit by the model, the resulting term would have been significantly positive or negative (for example, see Author, 2015). This treats the simulation as a complex baseline model. The two terms of interest to us here are brokerage and closure, which are equivalent to our two structural terms in the idea brokering process (Figure 2). Brokerage occurs when one actor mentions two preferences that are not co-mentioned by any other actor, creating an open brokering chain. This actor has thus made a new connection between the concepts, brokering them as it were – although only one actor is involved and actors could still be connected through another idea. We are especially interested in the closure of these arrangements, or closed brokering chain – a “4-cycle”. This is when two concepts are co-mentioned by two (or more) actors, showing a tighter connection between the ideas. Both are interesting processes in policy networks (Leifeld & Schneider, 2012) that estimate different stages of the idea brokering process.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Findings

We begin with a descriptive examination of the policy preference networks. Figure 4 shows the diagrams and summary information for each of the three networks. Taken together, the networks illustrate the transformation of the debate between the Bush and Obama Administrations. For instance, during the Bush Administration school-based accountability was a major topic of debate and received support across a wide range of policy actors. Senator Mike Enzi (R- WY) provides an example of a school-based accountability preference in a January 6, 2005 congressional hearing:

The centerpiece of that effort, the President's No Child Left Behind Act, emphasized accountability and the importance of getting results in the classroom. Thanks to that important legislation, our Nation's classrooms are more effective and efficient places of learning and our children are benefiting from that.

Meanwhile, few actors expressed a preference for teacher-based accountability during 2001-06.

[Figure 4 about here]

However, following the transition to the Obama Administration, it was evident that teacher-based accountability—alongside school-based accountability—became the central policy belief among the congressional hearing participants. In addition to the centrality of teacher-based accountability, a number of other teacher-based preferences concerning teacher evaluation emerged during this time, signaling a broader shift in the debate concerning the role of teachers in education reform. For example, Senator Tom Harkin (D- IA), explained in a hearing on November 8, 2011:

I believe the committee's bill takes several important steps forward by...incentivizing States and districts to develop rigorous teacher and principal evaluations and support systems, with the goal of continuous instructional improvement.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Similarly, in a congressional hearing held on February 28, 2013, Todd Rokita (R-IN) stated the following:

And we all want qualified teachers in the classroom but we must also recognize that a teachers’ excellence cannot be measured simply by degrees and diplomas alone. Recognizing the antiquated “Highly Effective Teacher” requirements alone weren’t helping schools attract the most promising teachers to the classroom, some states and school districts have been working to implement alternative methods to better evaluate the effectiveness of teachers.

Rep. Rokita’s statement refers to a key potential source of new ideas—leaders from states and local school districts that have tried new policies; these actors may provide recommendations for the expansion or nationalization of their policy reforms.

There were other notable trends in policy preferences expressed in hearings over time. During both administrations, many policy actors emphasized specific policy preferences for reforming teacher preparation and professional development by linking evaluation systems to pre-service and in-service teacher education. Relatedly, alternative certification programs, which provide licenses to new teachers without a degree from a school of education, had consistent support over both administrations. Support for pay for performance policies remained fairly strong in the Obama administration, but was mentioned more frequently during the Bush administration. Overall, these trends indicate support for policies focusing on efficiency, competition, and an increasing emphasis on specific policies related to individual teacher accountability. Next, we identified major policy actors based on their degree counts – or how many preferences each actor mentioned – during the policy window.

[Table 2 about here]

Major actors during the policy window cover a range of organizational affiliations (see Table 2). These actors are the most active contributors of teacher effectiveness policy preferences in Congressional hearings. Notably, two school districts that have been at the center

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

of education reform involving teacher quality—New York City and Washington D.C.—were also central participants in the debate during the policy window. Gadsden County Schools and the Richardson Independent School District, which are located in the metropolitan areas of Tallahassee, Florida and Dallas, Texas respectively, were also major actors during the policy window. Indicative of the shift toward teacher-based accountability, The New Teacher Project (a national organization involved in advocacy, research, and school district partnerships related to teaching) was a central actor during this transitional period. A number of think tanks, particularly the Center for American Progress, Education Trust and the Aspen Institute were major actors as well. The relatively high level of activity of the Obama administration is also notable and is indicative of the administration's push for its RTTT initiative.

Identifying Brokers

Our broker analysis focused on identifying closed brokerage chains, which we accomplished by calculating a 4-cycle count for each actor.⁴ We show the major brokers during each time period in Table 3. A somewhat varied mix of think tanks, foundations, and interest groups appear in these lists, including the Aspen Institute, the Bill & Melinda Gates Foundation, the Business Roundtable, and New Leaders for New Schools. A few organizations, such as Education Trust and the American Enterprise Institute, appear as brokers in more than one time period, but none appear in all three time periods. Additionally, local and state education authorities are involved in idea brokering. School districts are more prominent in brokering chains during the policy window, while state education authorities become prominent in brokering chains during the Obama period. Table 3 highlights this finding.

[Table 3 about here]

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Many of these brokers offered specific policy ideas and information based on trying approaches to evaluating teachers in their districts. For instance, Atlanta Superintendent Beverly Hall testified on July 17, 2008:

So we looked at improving the central office staff, our principals, and our teachers throughout hiring, through making it clear what expectations were, by using meaningful evaluations linked to student outcomes, and continuous professional development.

The chancellor of the Washington, D.C. public schools, Michelle Rhee, testified multiple times during the policy window of 2007 and 2009. In her testimony on September 16, 2009, Rhee stated: “First, there’s a lot of discussion these days about how—what the right way to evaluate teachers is. And we really believe in holding teachers accountable and using student achievement gains and test scores as one part of the way that a teacher should be evaluated.”

It is important to note that the brokers were not universal in their preferences for teacher accountability. Although most of the actors identified as brokers spoke in favor of adopting policies for teacher accountability, one particular broker witness describes sources of uncertainty about using teacher accountability policies. Representing the American Enterprise Institute (a broker organization in 2007-2009 and 2010-2015), Frederick Hess stated the following on September 30, 2009 (a statement we coded as expressing “uncertainty” about a preference):

Why not just judge teachers using value-added scores? A small but growing number of states can perform “value-added” calculations based on grade three-to-eight reading and math assessments. However, such scores are only available for a minority of teachers, even in states with the requisite data systems. A more fundamental problem is that these measures are imprecise and of uncertain reliability when just a few years’ worth of data are being used to judge individual teachers....Enabling district and school officials to use value-added gains and other metrics as one component of a smart, system-specific strategy makes good sense, but prescribing the use of such crudely drawn metrics from Washington is an entirely different matter.

This statement from Hess is unique in our testimony—witnesses rarely provide lengthy discussions of uncertainty about any policy ideas. For instance, in the very same hearing on

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

September 30, 2009, Layla Avila of The New Teacher Project stated: “Let’s create evaluations that differentiate great teaching from good, good from fair, and fair from poor. And use student growth as a critical component.” Based on the growth in popularity of teacher evaluation preferences it appears that policymakers were more attentive to the ideas shared by the majority of brokers who were highly supportive of teacher accountability, rather than the uncertainty and reservations expressed by Hess. The ERGM analysis provides further examination of how brokers might have impacted the policy discourse.

ERGM and Baseline Simulation Analysis

We used ERGM analysis and baseline simulations to assess our expectations about the role of idea brokers in the emergence of teacher effectiveness policy preferences during the Obama administration. Unlike our visualizations, these models use unweighted two-mode networks of organizational actors and policy preferences. The coefficients in Table 4 are similar to logit coefficients; they can be interpreted as conditional log-odds of a tie between an actor and a policy preference (a dyad), but the probability of observing any tie is conditional on all the other dyad outcomes in the network. To interpret the effects of the categorical variables we can exponentiate the coefficients to get the log-odds ratio between the reference group and any category. If, for example, we exponentiate the teacher accountability coefficient of 0.46 from the Obama period we can conclude that actors are 2.71 times more likely to mention teacher accountability preferences than alternative certification preferences from 2010-2015. In all models, we include a term for edges, which accounts for the baseline odds of creating a tie in the network. In addition, we used members of Congress and alternative certification as reference categories for organizational type and preference category variables respectively. Neither category had significant effects on the model overall and both categories represented the smallest

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

percentage of their node attribute in comparison to the other categories. The models presented show the same terms for all three time periods: Bush (2001-2006), policy window (2007-2009), and Obama (2010-2014).

[Insert Table 4 about here]

The results of the ERGM models show that organization type had almost no effect on the network structure. During both the Bush time period and during the 2007-2009 policy window, organization type was not significant. In particular, intermediaries, which have been agents of change in past research do not appear to have any significant effects on the adoption of teacher effectiveness policies in our analysis. Interestingly, the only significant organizational effects appear during the Obama administration when government actors appear to be more likely to show support for teacher effectiveness policies than other kinds of actors.

In contrast, there are a number of significant results based on policy preference categories. As the descriptive analysis suggests, actors were more likely to support school-based accountability preferences during both the Bush years and the policy window. By the time of the Obama administration, however, school-based accountability preferences are no longer popular. Incentive policies, meanwhile, clearly emerge and gain popularity during the policy window and continue to be popular within the policy discourse during the Obama years. The results for teacher accountability are particularly worthy of attention. While teacher accountability is not popular during either the Bush period or the policy window, these preferences become popular during the Obama period. Finally, teacher preparation policies are popular throughout all three time periods, suggesting the popularity of some preferences remains relatively constant while the popularity of other preferences evolves over time.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Notably, preferential attachment is not significant in either of the first two time periods, but is highly significant in the Obama period. A negative coefficient for preferential attachment is interpreted as a positive effect in an ERGM model (see Appendix for further discussion), which means preferential attachment emerges as a significant factor for tie formation in the policy discourse during the Obama years. Actor activity, meanwhile, is evident as a significant predictor of tie formation across all time periods.

Next, the results of the baseline simulations show different results for open and closed brokering chains. For open brokering chains, which included one actor occupying a unique space between two preferences that are not connected by any other actors, organizational type had significant effects, while policy preference categories did not (see Figure 5).

[Insert Figure 5 about here]

Figure 5 shows the results of the baseline simulations for open brokering chains by organizational type (top) and preference categories (bottom). Notably, intermediary organizations were significantly more likely to be involved in open brokerage chains during the Bush years and the 2007-09 policy window. Significance in this sense means an actor from an intermediary organization was more likely to be the only actor to endorse a particular pair of policy preferences than we would expect by chance. During the 2007-09 policy window, for example, Michelle Rhee from Students' First was the only actor to support using value-added models and peer observations to evaluate teachers. While other actors supported these preferences separately, Rhee uniquely supported both. Traditional actors (teachers, union representatives, and university affiliates) were also significantly more likely to occupy open brokering chains during the policy window, while government actors and members of Congress were significantly less likely to do so. None of the policy preference categories were more or less

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

likely to occupy open brokering chains during any time period. Interestingly, open brokering chains were rare and appeared prominently during the policy window, signaling the possible importance of open brokering chains during periods of policy change.

In contrast, the policy preference categories were significant for closed brokering chains, while organizational type appears to have little effect (see Figure 6). We see no effects for organizational type, except during the Obama period when government actors emerge as significant actors in brokering chains. This aligns with the results of the ERGM analysis.

[Insert Figure 6 about here]

In Figure 7, however, we see that policy preference categories were more likely to occur in closed brokering chains in different time periods. In the Bush period, alternative certification, incentive and teacher accountability preferences are all significantly more likely to be present in closed brokering chains. During the policy window and the Obama period, meanwhile, brokering chains are significantly more likely to include incentive and teacher accountability preferences. Alternative certification policies also reappear as significant components of closed brokering chains.

When considered alongside the ERGM analysis, the brokering analysis provides evidence to support our main hypothesis. In particular, the teacher accountability and incentive preferences reveal a pattern of brokering followed by an increase in the popularity of these preferences. In Table 5 we highlight when popularity for preferences emerges following a period of idea brokering.

[Insert Table 5 about here]

The ERGM analysis shows that teacher accountability preferences are not popular during the Bush period or the policy window, while the brokering analysis shows that these preferences are

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

significantly more likely to occur in closed brokering chains during these periods. In the following time period – during the Obama administration – teacher accountability policies become popular. Likewise, incentive preferences are not popular during the Bush period, but they are significantly more likely to appear in closed brokering chains during this time period. Then, during the policy window, incentive policies emerge as a popular policy preference. It is also notable that, when the preference becomes popular, there is large increase in the significance of the simulation results. For teacher accountability, for example, there is markedly greater distance between the expected value and the empirical result during the Obama period in comparison to the two previous time periods. This is also true for incentive preferences during the policy window (see Figure 6). This suggests brokers may play a different role once a preference becomes popular. The baseline simulation results for open brokering chains, meanwhile, suggest that certain interest groups may play a particular kind of brokering role by making new connections between preferences in the policy discourse during the policy window.

Discussion and Conclusion

This article contributes theoretically, methodologically and substantively to the study of brokers in policy networks and their potential role in policy change. Past research has illustrated the ways that a variety of intermediary actors in education have reached a general consensus on supporting choice-based reform organizations in education, especially among philanthropic foundations and education advocacy organizations (Authors, 2017; Authors, 2016; Author, 2013; Authors, 2014; Scott & Jabbar, 2014). We show how brokers in policy networks facilitate knowledge transfer and consensus in the public discourse about public school teachers.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Theoretically, we expand on previous work that highlights the rising importance of ideas in policy change processes. While past scholarship has successfully explicated idea-based politics through the prism of shifting paradigms and/or idea sets (e.g., Mehta, 2013), our analysis provides further detail on the mechanisms behind idea-centered policy change. We are not the first to suggest that brokers play a key role in facilitating change in policy networks, but we offer insight into the temporal and structural nature of the brokering phenomenon in idea-centered reforms by linking the brokering process to discourse networks.

Our analysis has particular importance for understanding the formation and evolution of political coalitions in educational policy. We show that the time-specific context of ideas matters. The presence of brokering between preferences that are not popular, but then become popular in a later time period – as we see in our data – provides evidence that idea brokers contribute to policy convergence around a particular core belief – in this case teacher effectiveness – within like-minded coalitions. Here we observe a major policy shift within a coalition, with actors who share policy goals focused on efficiency also converging on support for a growing set of policy instruments. Major policy change is often studied between coalitions and couched as one coalition replacing another, but this is not always the case. Sometimes a dominant coalition extends its reach into new areas when brokers within that coalition promote new ideas. Thus, our approach is a theoretical advance of policy change within coalitions– a particularly important endeavor when one coalition is dominant.

Our findings also suggest that idea brokers may play a different role depending on the context. After teacher accountability preferences emerge as popular policy ideas in the Obama period, for example, idea brokering is very prominent. At the same time, preferential attachment also becomes a critical factor in shaping the network – actors are supporting preferences because

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

they are popular. At this point, the popularity of these ideas has taken on a life of its own, suggesting a different kind of role for idea brokers. While idea brokers may continue to operate, they may be acting more as coordinators, maintaining the dominance of a particular set of ideas, rather than acting as agents of change. Likewise, our results show that some interest groups may play an important role by making new connections between ideas in the policy discourse during policy windows when government actors are likely more open to policy change.

Methodologically, we show the usefulness of statistical network modeling for understanding the behavior of policy coalitions in educational contexts. While this kind of analysis is commonplace in studies that focus on the sociology of education (e.g., Frank, Zhao, & Borman, 2004), there is little research of this kind that focuses on the politics of education. We build on and expand existing research on educational policy and politics that examines organizational networks (e.g., Hodge, Salloum, & Benko, 2016). Our findings further show how ERGM analysis can be used to observe two-mode network structures and examine policy change.

Our study also has implications for studying brokering in policy networks. By observing the prominence of different policy preferences over time alongside the tendency for idea brokerage to occur amongst particular sets of preferences we can show how idea brokers shape the policy debate. The use of different time slices in our analysis illustrates the importance of timing for brokering, which appears to be most effective during policy windows. In alignment with network theory, this suggests that brokers' locations provide them with opportunities to shape the policy discourse. Our approach may also inform other educational research, and particularly research on educational change, that uses social network analysis which, in the past, have focused on one-mode interpersonal networks (e.g., Daly & Finnegan, 2010). Our analysis

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

shows that organizational change can be linked to other entities, like ideas. In other kinds of educational research this could be something else, like attitudinal dispositions or experiences, such as attitudes towards teaching or professional development events.

Substantively, this study informs the growing literature on intermediary organizations in educational politics, which focuses on identifying key actors by organizational type. Our results indicate that researchers may consider an expanded definition of intermediaries in educational politics. While the bulk of research on intermediary organizations has focused on the influence of non-profit organizations, such as think tanks, advocacy groups, and foundations, our analysis also shows that many other types of organizations can act as idea brokers in policy networks. Our finding that major school districts are central actors in forwarding particular policy agendas – in this case teacher effectiveness reforms – is especially relevant. Past accounts of philanthropic giving in educational politics has identified districts as important conduits of reform movements (Scott, 2009; Author, 2010). Scott (2009), for example, shows how school districts can be used as proving grounds for networks of reformers aiming to expand charter school policies. Our analysis also shows the importance of some university-based actors and politicians in setting the policy agenda. Overall, researchers may consider using network structure, rather than a substantive categorization, to identify intermediaries in education policymaking processes.

Lastly, our research has implications for analysis of future developments in U.S. educational policy, including state-level responses to the newly adopted ESSA legislation. As states develop plans for assessments and standards—including metrics for evaluating new categories of educational outcomes—idea brokers could play a crucial role in shaping state policy agendas. Yet these debates are also taking place in a fluid political context, which might

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

be shaped by rising partisan polarization within education policy (Barnum 2016). Future research could produce a fruitful and more detailed understanding of the rise of policy ideas in education across different levels of government, or within state contexts with varying levels of partisan polarization. In particular, by identifying idea brokers during policy windows, researchers can identify actors that may serve as important leverage during the policymaking process. Whether or not ties to idea brokers result in changes to legislative votes would make an important contribution to future work in this area.

Notes

¹ Conceptually, this process can be linked to theories of idea-based policy change. Grounded in the process of social learning, idea-based theories of policy change maintain that policies are a consequence of past policies (Heclo, 1978). Weir and Skocpol (1985), for example, argue that the interests of policymakers and their policy preferences are shaped by “policy legacies” or “meaningful reactions to previous policies” (p. 119).

² Our use of “preferences” is conceptually somewhere in between ACF’s secondary beliefs and policy core beliefs. While the ACF places their “policy core preferences” at the policy core belief level, we located it at the secondary belief level. This was reasonable for our purposes because we were conducting analysis inclusive of one policy core belief. In addition, we needed a to distinguish between different types of preferences – the goals and instruments – while keeping them within the same level of beliefs. It did not make sense to locate policy instruments at the policy core belief level.

³ Our decision to exclude the question and answer segments of the hearings is based on Fisher, Waggle, and Leifeld’s approach to discourse network analysis of congressional testimony on climate change. We elected to analyze only witness statements that demonstrate specific policy preferences, as opposed to the back-and-forth dialogue between witnesses and policymakers. Like Fisher, Waggle, and Leifeld, we determined that this decision would provide a reliable and systematic process for coding. Witness statements are entered into the record with consistency in duration, form and style, whereas question and answer portions are frequently dominated by some voices over others; are dependent on background context that is not included in the record, nor that can be specifically linked to a single witness; and vague or off-topic.

⁴ We focused on brokers located in closed brokering chains because they were far more numerous than those located in open brokering chains. Further, while our analysis revealed some interesting patterns related to open brokering chains, closed brokering chains represented the policy process of most interest: convergence around a particular set of policy preferences.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

References

Author, 2009.

Author, 2013.

Author, 2014.

Author, 2015a.

Author, 2015b.

Author, 2016.

Author, 2017.

Baumgartner, F. R., & Jones, B. D. (1993). *Agendas and instability in American politics*. Chicago: University of Chicago Press.

Baumgartner, F. R., & Jones, B. D. (2012). From there to here: Punctuated equilibrium to the general punctuation thesis to a theory of government information processing. *The Policy Studies Journal*, 40(1), 1-19.

Barnum, M. (2016). Analysis: How Betsy DeVos could scramble the ideology and politics of education reform. The 74. <https://www.the74million.org/article/the-break-up-how-betsy-devos-could-scramble-the-ideology-and-politics-of-education-reform/>

Bertelli, A. M., & Wenger, J. B. (2009). Demanding information: Think tanks and the U.S. Congress.” *British Journal of Political Science*, 39(2), 225-242.

Booher-Jennings, J. (2005). Below the Bubble: “Educational triage” and the Texas accountability system. *American Educational Research Journal*, 42(2), 231-268.

Borgatti, S.P., 2002. *NetDraw software for network visualization*. Analytic Technologies: Lexington, KY.

Brandes, U., & Wagner, D (2004) Visone: analysis and visualization of social networks. In Michael Jünger and Petra Mutzel (Eds.) *Graph Drawing Software*, pp. 321-340. © Springer-Verlag, 2004.

Burstein, P., & Hirsh, C. E. (2007). Interest organizations, information, and policy innovation in the U.S. Congress.” *Sociological Forum*, 22(2), 174-199.

Burt, R. S. (1992). *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

- Burt, R. S. (2004). *Brokerage and closure: An introduction to social capital*. Oxford, UK: Oxford University Press.
- Daly, A. J., & Finnegan, K. S. (2010). A bridge between worlds: understanding network structure to understand change strategy. *Journal of Educational Change*, 11(2), 111-138.
- DeBray-Pelot, E. & McGuinn, P. (2009). The new politics of education: Analyzing the federal education policy landscape in the post-NCLB era." *Educational Policy*, 23(1), 15-42.
- Finger, L. (2018). Vested interests and the diffusion of education reform across the states. *Policy Studies Journal*, 46(2): 378-401.
- Fisher, D. R., Waggle, J., & Leifeld, P. (2013). Where does political polarization come from? Locating polarization within the U.S. climate change debate. *American Behavioral Scientist*, 57(1), 70-92.
- Foderaro, L. W. (2010, April 18). Alternative path for teachers gains ground. *The New York Times*. Retrieved from <http://www.nytimes.com/2010/04/19/education/19regents.html?pagewanted=all>.
- Frank, K. A., Zhao, Y., & Borman, K. (2004). Social capital and the diffusions of innovations within organizations: The case of computer technology in schools. *Sociology of Education*, 77(2), 148-171.
- Fuller, B., Wright, J., Gesicki, K., & Kang, E. (2007). Gauging growth: How to judge No Child Left Behind? *Educational Researcher*, 36(5), 268-278.
- Gimpel, J. G., Lee, F. E., & Pearson-Merkowitz, S. (2008). The check is in the mail: Interdistrict funding flows in congressional elections. *American Journal of Political Science*, 52(2), 373-394.
- Goldstein, J., & Keohane, R. O. (1993). Ideas and foreign policy: An analytical framework. In J. Goldstein & R. O. Keohane (Eds.), *Ideas and foreign policy: Beliefs, institutions, and political change* (pp. 3-30). Ithaca, NY: Cornell University Press.
- Gould, R., & Fernandez, R. (1989). Structure of mediation: A formal approach to brokerage in transaction networks. *Sociological Methodology*, 19, 89-126.
- Hamilton, L. S., Stecher, B. M., Marsh, J. A., McCombs, J. S., & Robyn, A. (2007). *Standards-based accountability under No Child Left Behind: Experiences of teachers and administrators in three states*. Rand Corporation.
- Handcock, M., Hunter, D., Butts, C., Goodreau, S., Krivitsky, P., Bender-deMoll, S., & Morris, M. (2016). *statnet: Software Tools for the Statistical Analysis of Network Data*. The Statnet Project (<http://www.statnet.org>). R package version 2016.9, [CRAN.R-project.org/package=statnet](http://cran.r-project.org/package=statnet).

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Handcock, M., Hunter, D., Butts, C., Goodreau, S., & Morris, M. (2008). statnet: Software tools for the representation, visualization, analysis and simulation of network data. *Journal of Statistical Software*, 24(1), 1–11. <http://www.jstatsoft.org/v24/i01>.

Hartney, M., & Flavin, P. (2011). From the schoolhouse to the statehouse: Teacher union political activism and U.S. state education reform policy. *State Politics & Policy Quarterly*, 11(3), 251-268.

Heclo, H. (1978). Issue networks and the executive establishment. In A. King (Ed.), *The new American political system*. Washington DC: American Enterprise Institute.

Heaney, M. T. (2006). Brokering health policy: Coalitions, parties, and interest group influence. *Journal of Health Politics, Policy, and Law*, 31(5), 887-944.

Hodge, E., Salloum, S. J., & Benko, S. L. (2016). (Un)commonly connected: a social network analysis of state standards resources for English/Language Arts. *AERA Open*, 2(4), 1-19.

Jabbar, H., Londe, P. G. L., Debray, E., Scott, J., & Lubienski, C. (2014). How policymakers define ‘evidence’’: the politics of research use in New Orleans. *Policy Futures in Education*, 12(8), 286-303.

Kingdon, J. W. (1984). *Agendas, alternatives, and public policies*. Boston: Little, Brown.

Leifeld, Philip. (2013). Reconceptualizing major policy change in the advocacy coalition framework: A discourse network analysis of German pension politics. *Policy Studies Journal*, 41(1), 169-198.

Leifeld, P. (2016). Policy debates as dynamic networks: *German pension politics and privatization discourse*. Chicago: University of Chicago Press.

Leifeld, Philip, and Volker Schneider. (2012). Information exchange in policy networks." *American Journal of Political Science* 56(3), 731-744.

Mayhew, Bruce H. (1984). Baseline models of sociological phenomena. *Journal of Mathematical Sociology* 9(3), 259-281.

McDonnell, L. M. (2013). Educational accountability and policy feedback. *Educational Policy*, 27(2), 170-189.

McDonnell, L. M., & Weatherford, S. M. (2013). Organized Interests and the Common Core. *Educational Researcher*, 42(9), 488-497.

McGuinn, P. (2012). Stimulating reform: Race to the Top, competitive grants and the Obama education agenda. *Educational Policy* 26, 136-59.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

- Mehta, J. (2010). From "whether" to "how": The varied roles of ideas in politics. In D. Beland & R. H. Cox (Eds.), *Ideas and politics in social science research* (pp. 23-46). Oxford, UK: Oxford University Press.
- Mehta, J. (2013). How paradigms create politics. *American Educational Research Journal*, 50(2), 285-324.
- Mehta, J., & Teles, S. (2012). Jurisdictional politics: A new federal role in education. In F. M. Hess & A. P. Kelly (Eds.), *Carrots, sticks, and the bully pulpit: Lessons from a half-century off federal efforts to improve America's schools* (pp. 197-216). Cambridge, MA: Harvard Education Press.
- Obstfeld, D. (2005). Social networks, the *Tertius Iungens* orientation, and involvement in innovation. *Administrative Science Quarterly*, 50, 100-130.
- Obstfeld, D., Borgatti, S. P., & Davis, J. (2014). Brokerage as a process: Decoupling third party action from social network structure. *Research in the Sociology of Organizations*, 40, 135-159.
- Perna, L. W., Orosz, K., & Kent, D. C. 2019. The role and contribution of academic researchers in congressional hearings: A critical discourse analysis. *American Educational Research Journal*, 56(1): 111-145.
- Rhodes, R. A. W. (2006). Policy network analysis. In M. Moran, M. Rein, & R. E. Goodin (Eds.), *The Oxford handbook of public policy*, (423-45). Oxford, UK: Oxford University Press.
- Sabatier, P. A. (1988). An advocacy coalition framework of policy change and the role of policy-oriented learning therein. *Policy Sciences*, 21(29-168).
- Sabatier, P. A., & Jenkins-Smith, H. C. (1993). *Policy change and learning: An advocacy coalition approach*. Boulder, CO: Westview Press.
- Saldaña, J. (2012). The coding manual for qualitative researchers, second edition. London: Sage Publications Ltd.
- Scott, J. (2009). The politics of venture philanthropy in charter school policy and advocacy. *Educational Policy*, 23, 106-136.
- Scott, J., & Jabbar, H. (2014). The hub and the spokes: Foundations, intermediary organizations, incentivist reforms, and the politics of research evidence. *Educational Policy*, 28(2), 233-257.
- Shipp, D. (2011). The politics of educational reform: Idea champions and policy windows. In D. E. Mitchell, R. L. Crowson, & D. Shipp (Eds.), *Shaping education policy: Power and process* (pp. 259-285). New York, NY: Routledge.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Victor, J. N. & Ringe, N. (2009). The social utility of informal institutions: Caucuses as networks in the 110th U.S. House of Representatives. *American Politics Research*, 37(5), 742-766.

Weir, M., & Skocpol, T. (1985). State structures and the possibilities for 'Keynesian' responses to the Great Depression in Sweden, Britain and the United States. In P. B. Evans, D. Rueschemeyer, & T. Skocpol (Eds.), *Bringing the state back in* (pp. 107-168). New York, NY: Cambridge University Press.

Wolbrecht, C. & Hartney, M. T. (2014). Ideas about interests: Explaining the changing partisan politics of education. *Perspectives on Politics*, 12(3), 603-630.

Wood, D. B., & Theobald, N. A. (2003). Political responsiveness and equity in public education. *American Journal of Political Science*, 65(August), 718-738.

U.S. Department of Education (2009). *Race to the Top program executive summary*. Retrieved from <https://www2.ed.gov/programs/racetothetop/executive-summary.pdf>.

U.S. Department of Education. *ESEA flexibility*. Retrieved from <https://www2.ed.gov/policy/elsec/guid/esea-flexibility/index.html>.

United States. (2009). *The American Recovery and Reinvestment Act helping middle class families*. Washington, D.C.: Middle Class Task Force, the Vice President of the United States. Retrieved from <https://www.gpo.gov/fdsys/pkg/BILLS-111hr1enr/pdf/BILLS-111hr1enr.pdf>.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Table 1. Abbreviations for Policy Goals and Instruments

<i>Category</i>	<i>Abbreviation</i>	<i>Preference Code (goals are indicated with bold text, with specific policy instruments listed below each goal)</i>
<i>School-based accountability</i>	sac	Hold schools accountable for student performance
	sac_maintain	Maintain/establish a system of annual high stakes testing
	sac_inputs	Use standardized testing to measure individual teacher inputs
	sac_quality	Use school level testing to assess teacher quality
<i>Teacher accountability</i>	tac	Teacher must be evaluated and held accountable
	tac_grow	Use evaluation systems with growth models
	tac_multiple	Use evaluation systems with multiple measures
	tac_student	Use evaluation systems with student feedback
	tac_observe	Use evaluation systems with classroom observations
	tac_vam	Use evaluation systems with value-added models
	tac_peer	Use evaluation systems with peer reviews
<i>Incentive-based improvement</i>	inc	Teachers and educational leaders respond to performance-based incentives
	inc_pay	Use pay for performance
	inc_decide	Use performance measures for personnel decisions (retention/dismissal, promotion, and/or tenure)
	inc_fund	Use federal funds to incentivize states and districts to adopt teacher quality reforms
<i>Teacher preparation and support</i>	tpr	Teacher preparation and professional development must be more efficient and effective
	tpr_assess	Use teacher evaluation systems to assess the quality of teacher preparation programs
	tpr_pd	Use evaluations to improve professional development
	tpr_feedback	Use evaluations to provide ongoing feedback to teachers
	tpr_identify	Use evaluations to identify and emulate the best teachers
<i>Alternative pathways</i>	alt	Good preparation for teaching does not require training in an education school
	alt_certify	Enact alternative certification programs that provide licenses to new teachers without a degree from a school of education
	alt_recruit	Enact alternative certification programs to attract more competitive individuals to the teaching profession

Notes: Preferences reflect beliefs, that are then expressed through a particular goal, and the strategies to meet the goal are instruments (see Figure 1).

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Table 2. Major Actors During 2007-09 Policy Window

Policy Actor	# Teacher Effectiveness Preferences Mentioned
DC Public Schools	14
Obama administration	13
Aspen Institute	12
Center for American Progress	12
Education Trust	12
New York City Department of Education	8
Council of Chief State School Officers	7
DC Preparatory Academy	7
Gadsen County Schools	7
National School Boards Association	7
Richardson Independent School District	7
The New Teacher Project	7
Alliance for Excellent Education	6
Chicago Public Schools	6
Minneapolis Public Schools	6
Stanford University	6
Boston Teacher Residency	5
Johns Hopkins University	5
National Institute for Excellence in Teaching	5

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Table 3. Major Brokers in Different Time Periods

Bush (2001-2006)	Policy Window (2007-2009)	Obama (2010-2015)
Bush administration (1)	Alliance for Excellent Education	American Enterprise Institute
Carnegie Corporation of New York	American Enterprise Institute	American Federation of Teachers
DC Public Charter School Board	Aspen Institute (1)	<i>Baboquivari Unified School District</i>
<i>DC Public Schools</i> (3)	<i>Atlanta Public Schools</i>	Bill & Melinda Gates Foundation
Department of Energy	Bloomberg Administration	Business Roundtable
Education Leaders Council (2)	Bush administration	Center for American Progress
Education Trust	Center for American Progress (2)	<i>Colorado State Board of Education*</i>
Educational Testing Service	<i>Chicago Public Schools</i>	<i>Denver Public Schools</i>
Fletcher administration	Council of Chief State School Officers	<i>Harrison School District 2</i>
Floyd County Board of Education	Council of the Great City Schools	Harvard University
GlaxoSmithKlein	DC Preparatory Academy	Herron High School
KnowledgeWorks Foundation	<i>DC Public Schools</i> (3)	<i>Idaho Department of Education*</i>
Learning Point Associates	Education Trust	<i>Indiana Office of Public Instruction*</i> (5)
Milken Family Foundation (5)	Fairfax County Public Schools	<i>Kentucky Department of Education*</i>
National Urban League	<i>Gadsden County Schools</i>	<i>Knox County Schools</i>
Recovery School District	Johns Hopkins University	Learning Point Associates
Romney administration (4)	<i>Minneapolis Public Schools</i>	Manhattan Institute
The Teaching Commission	National Education Association	<i>Miami-Dade County Public Schools</i>
University of Pennsylvania	National Institute for Excellence in Teaching	<i>New Mexico Public Education Department*</i> (3)
University of Texas Austin	National School Boards Association	<i>New York State Education Department*</i>
	New Leaders for New Schools	New York University
	<i>New York City Department of Education</i>	<i>North Carolina Department of Public Instruction*</i>
	Obama administration (4)	Obama administration (1)
	<i>Richardson Independent School District</i> (5)	<i>Salem-Keizer School District</i>
	Stanford University	<i>Tennessee Department of Education*</i> (4)
	The New Teacher Project	The New Teacher Project (2)
		University of Virginia
		<i>Virginia Department of Education*</i>

Notes: All local and state education authorities are highlighted in italics. State education agencies also have an asterisk [*]. The top five actors in each time period are denoted by a number in parentheses. The numbers represent their rank, 1-5 with (1) being actor that appeared most frequently in brokering chains.

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Table 4. Results of ERGM Analysis

Probability of a tie between actors and ideas in teacher effectiveness network	Bush (2001-2006)	Policy Window (2007-2009)	Obama (2010-2015)
Edges	-0.39	-1.19**	-0.42*
Node Attributes (Mode 1)			
Government Actor	0.47	0.15	0.33*
Intermediary	0.47	0.19	0.06
Traditional Actor	0.04	0.22	-0.02
Node Attributes (Mode 2)			
Incentives	0.05	1.34***	0.36*
School-based Accountability	0.70*	1.29***	0.23
Teacher Accountability	-0.52	0.44	0.46**
Teacher Preparation	0.96***	1.54***	0.42**
Policy Goal/Instrument	-1.91***	-1.35***	-1.13***
Endogenous Terms			
Actor Activity (mode 1, $\alpha=1$)	-4.03***	-3.68***	-3.57***
Preferential Attachment (mode 2, $\alpha=1$)	-1.34	0.14	-6.25***
AIC	-2405.78	-2083.31	-1985.71
BIC	-2340.80	-2018.08	-1919.26
Log Likelihood	1213.89	1052.66	1003.85

IDEA BROKERAGE IN TEACHER POLICY NETWORKS

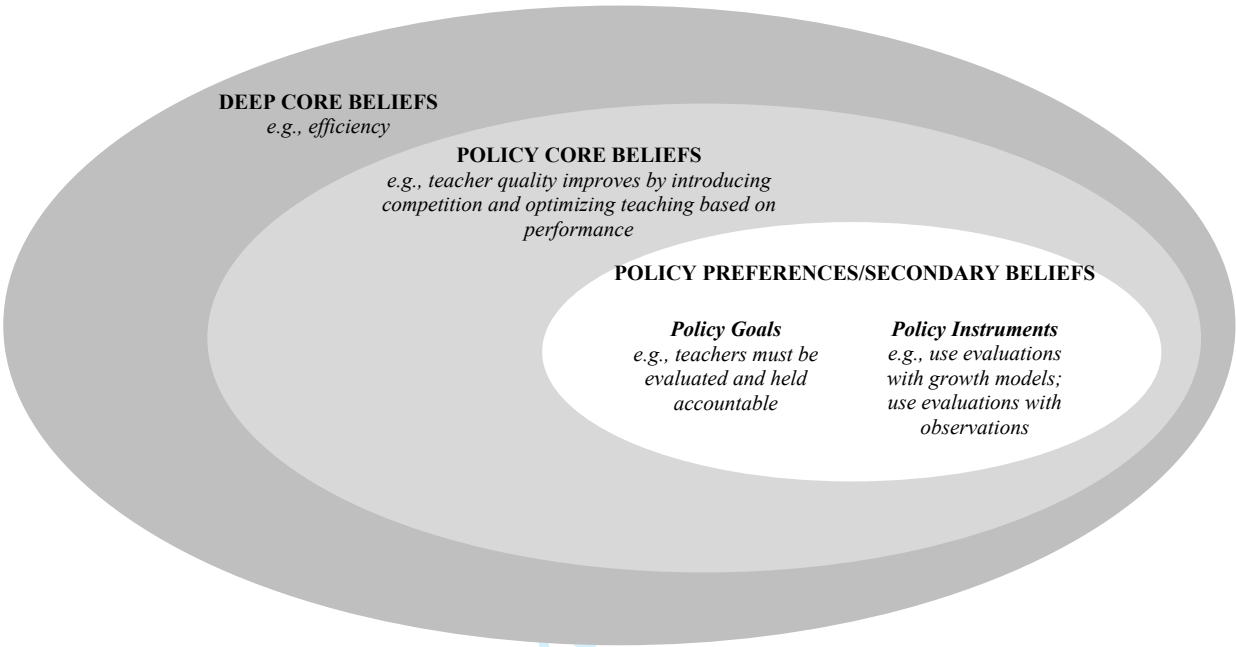
Table 5. Comparison of Popularity and Brokerage over time for Different Preference Categories

		Bush (2001-06)	Policy Window (2007-09)	Obama (2010-15)
School-based accountability	<i>popularity</i>	*	***	
	<i>brokerage</i>			
Teacher accountability	<i>popularity</i>			**
	<i>brokerage</i>	+	+	++
Incentive-based improvement	<i>popularity</i>		***	*
	<i>brokerage</i>	+	++	
Teacher preparation and support	<i>popularity</i>	***	***	***
	<i>brokerage</i>	—	—	

Notes: The asterisks [*] correspond to the significance level from the ERGM results, denoting the popularity of each preference category. The crosses [+] correspond to the significance of the empirical number of homophilous 4-cycle brokering chains that contain each preference category.

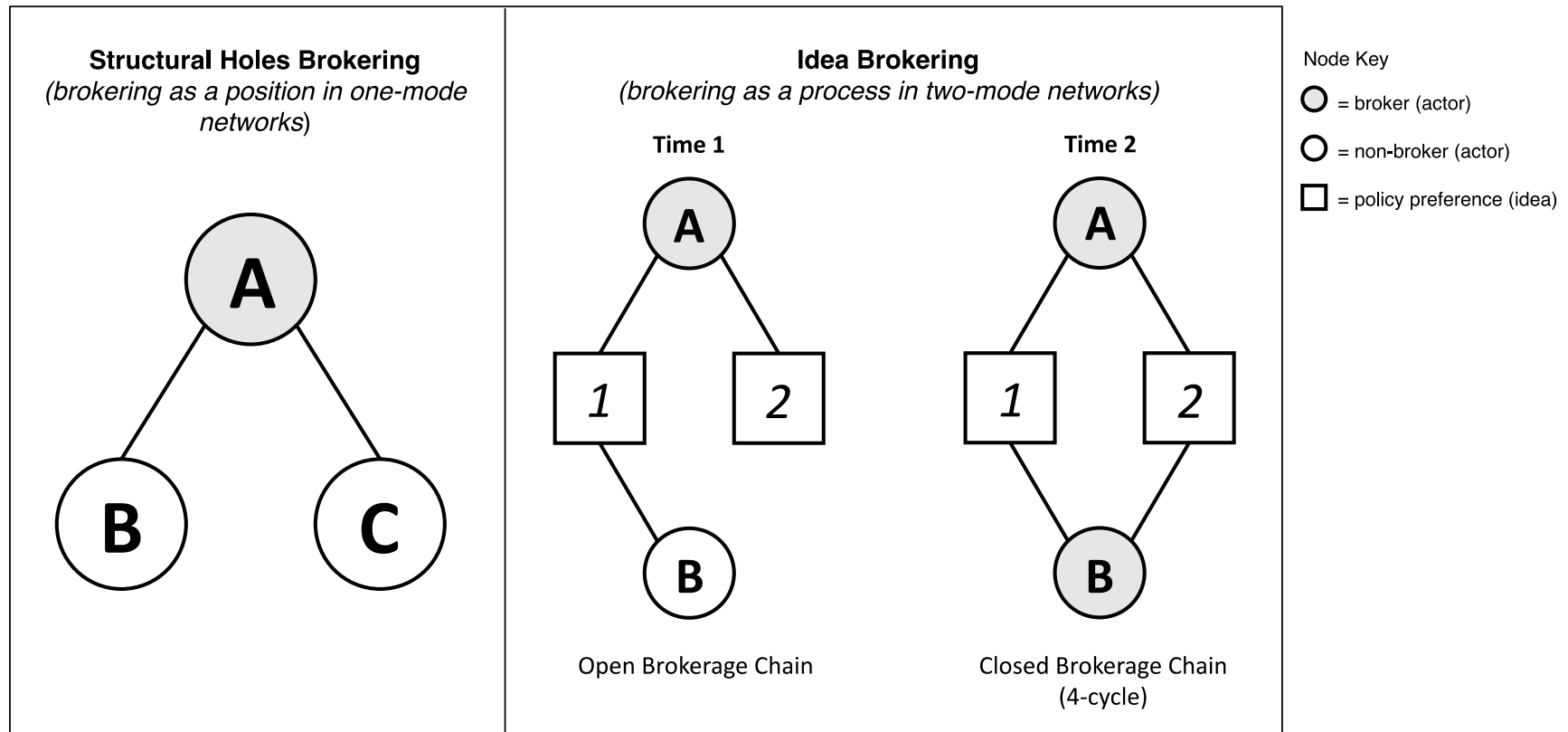
IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Figure 1. The Advocacy Coalition Framework Three-tiered System of Beliefs



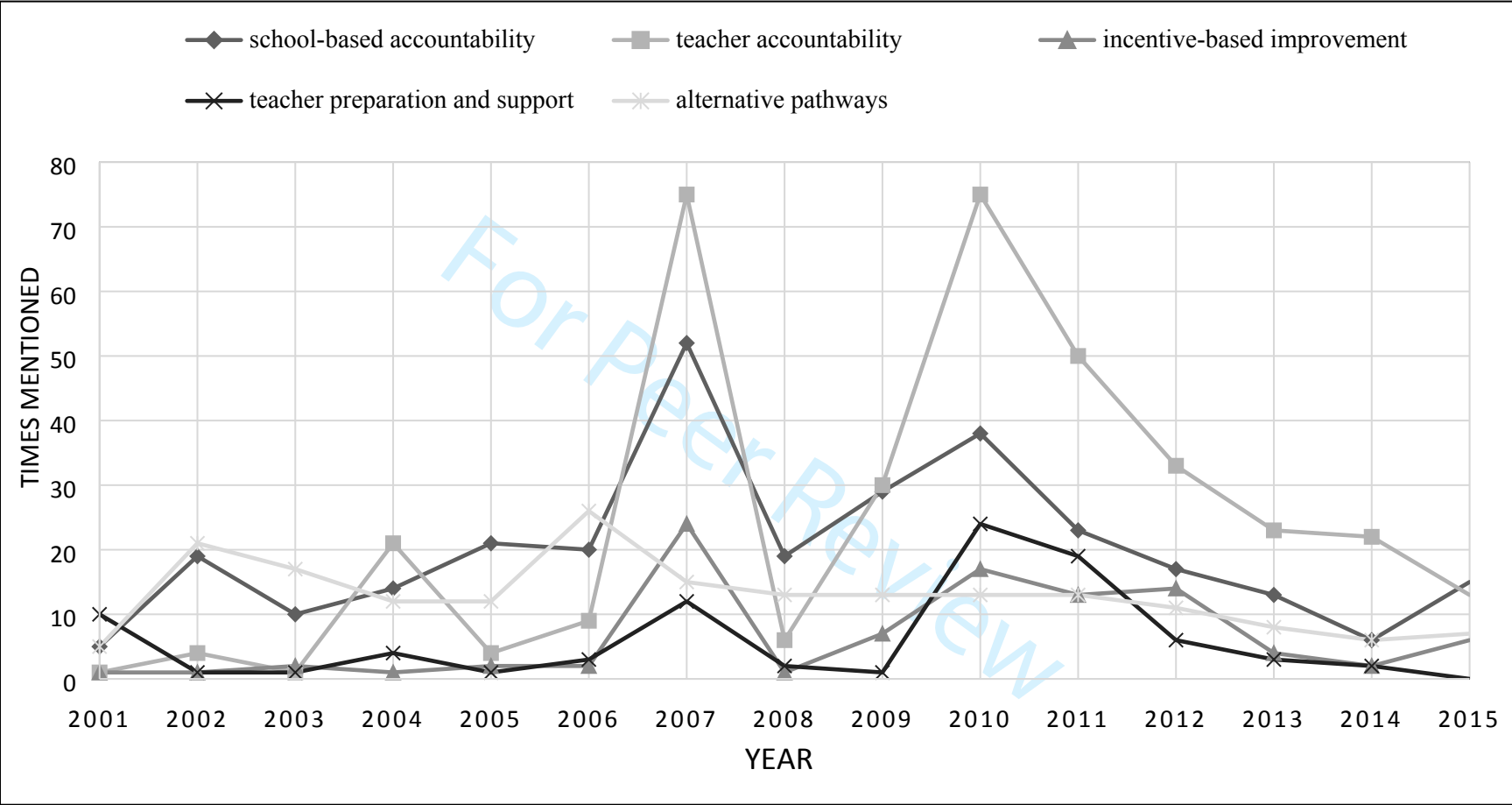
IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Figure 2. Different Conceptualizations of Brokerage



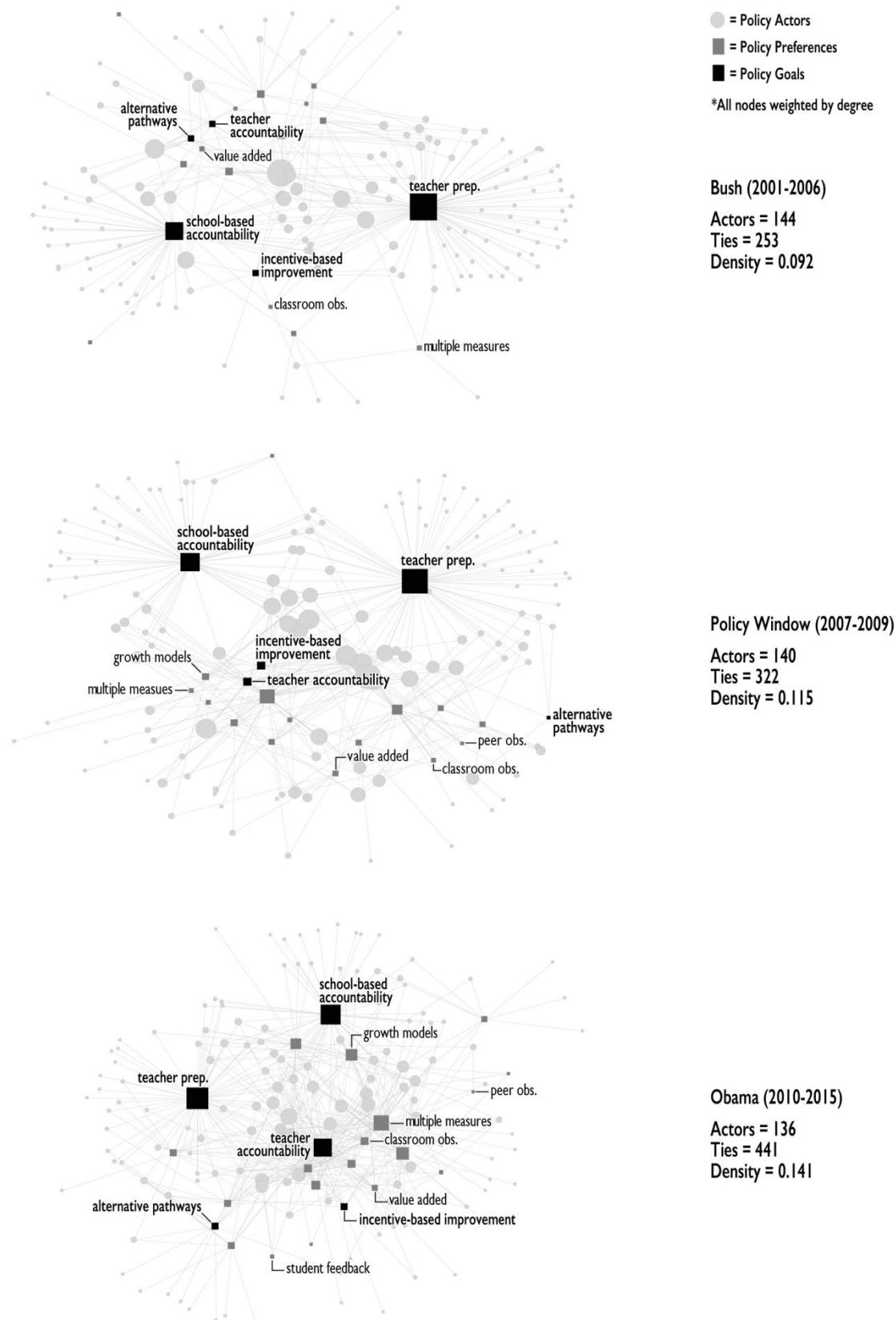
IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Figure 3. Policy Preferences Mentioned Over Time, 2001-2015



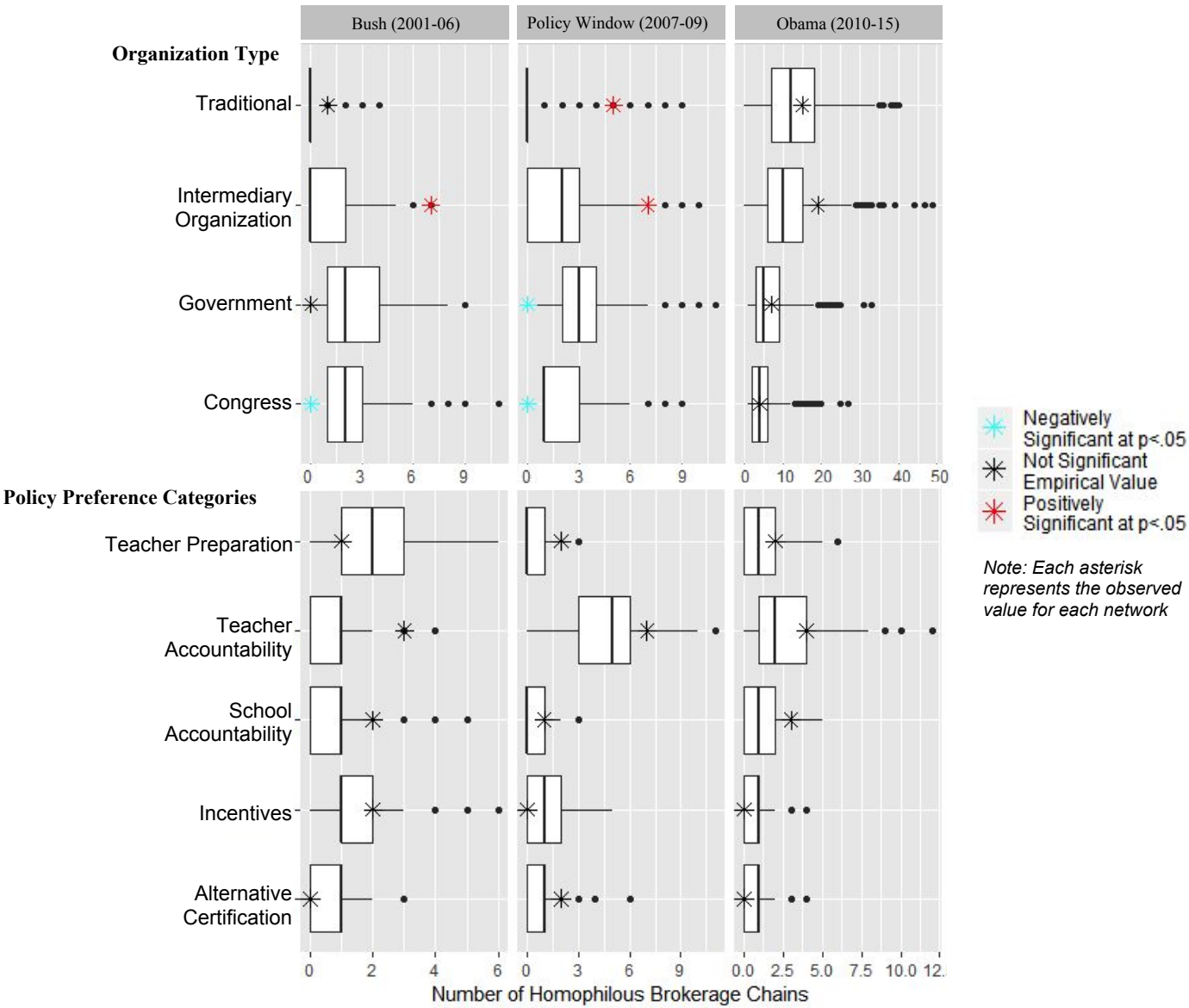
IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Figure 4. Network Diagrams and Information for Different Time Periods



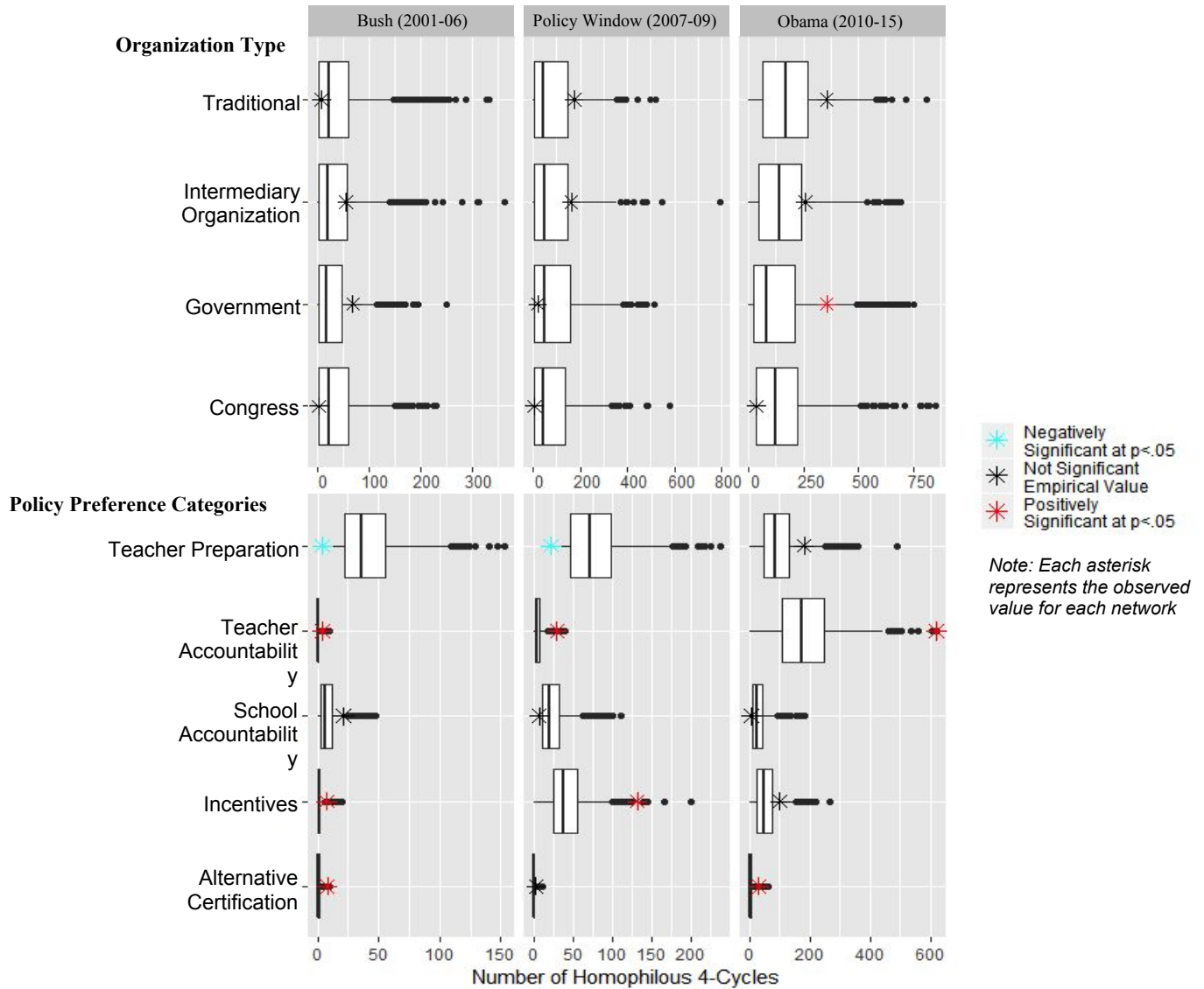
IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Figure 5: Simulation Results for Open Brokerage Chains



IDEA BROKERAGE IN TEACHER POLICY NETWORKS

Figure 6: Simulation Results for Closed Brokerage Chains (4-cycles)



APPENDIX

A. Interpretation of model results

In this section we compare the chances of a specific tie in each of the three time periods to show both the comparative aspect of the ERGM framework as well as a micro-level interpretation of these results. Consider a mention of incentives by a Government actor. This actor has no other mentions, but the specific policy is mentioned by 2 other actors as well. To understand the probability of this tie in each time period we first add up the relevant coefficients in log-odds form and then can transform back to a probability. For this specific tie, the only relevant significant term in the Bush model is Actor Activity (-4.03***). All the other terms are either non-significant (like Incentives), or do not apply to this term (like Teacher Preparation). Because this is the first tie for the Actor, the geometric weighting of the Actor Activity term is equal to 1. Thus, the total log-odds of this tie is simply -4.03. This converts to a probability of 1.7% using an inverse logit. In other words, the probability of this tie is relatively low, however that will be true for all ties in a sparse network.

In the Policy Window, we have a very different story. The edges term is significant so it must be included. Also, the term for an Incentive mention is also significant. We also include the Actor Activity term as well. Thus, the total log odds is given as $(-1.19)+1.34+(-3.68)=-3.53$, which converts to a probability of 2.8%, or almost double the chances of occurring as under the Bush Administration.

Finally, the most complex analysis is that for the Obama Administration. Here, the term for edges is significant (-0.42), the tie for a Government actor adding a tie (.33), as well as for a mention of Incentives (0.36), Actor Activity (-3.57), and also Preferential Attachment for mentions (-6.25). Unlike with Actor Activity, where the added edge would only increase the degree from 0 to 1 (and thus the full weight of the coefficient applies), in changing from 1 to 2 the geometric weighting kicks in. With $\alpha=1$, the geometrically weighted contribution of the coefficient is 0.63, thus yielding a total log-odds for this tie of $(-0.42)+0.36+(-3.57)+(0.63)*(-6.25)=-7.57$ which converts to a probability of 0. Compare this to the probability of a tie if Intervention had 9 other ties. When adding the 10th, the geometric weighting changes from 0.63 to 0.01, yielding a log-odds of -3.69 and a probability of 2%. This shows the power of the anti-preferential attachment terms. Given that they are significant and negative, we see that higher-order ties are far more likely under the Obama Administration than ties to ideas with fewer other ties. For more information on these terms see Snijders et. al (2006), Levy (2016), and for specifics on how to calculate the geometrically weighted terms, see Morris (2015).

B. Goodness of Fit

In ERG models, goodness of fit is essential for whether or not the model results can be interpreted (Hunter et al. 2008). The figures below (A1, A3, and A3) show goodness of fit information for the three models presented in the paper. The thick line shows the p-value for the empirical data compared to box-plots from 1000 simulations. The relative approximation of the empirical data by the simulations show that the models converged well and the results can be interpreted.

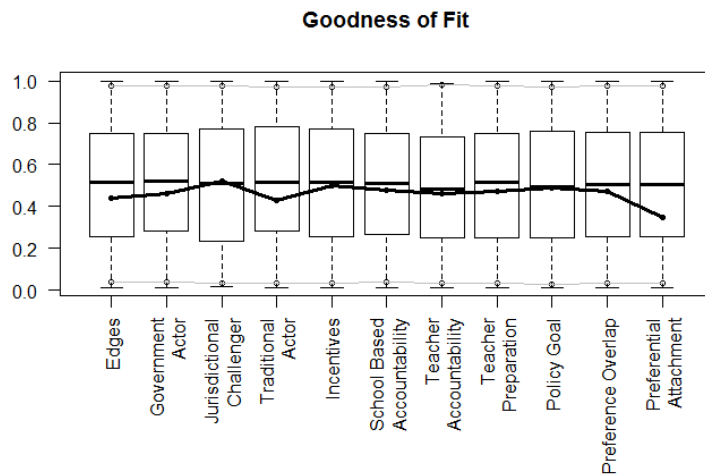


Figure A1: Goodness of Fit for the Bush Administration model. The Y-axis is the p-value for the coefficients in the model. A lack of significant p-values indicates good fit.

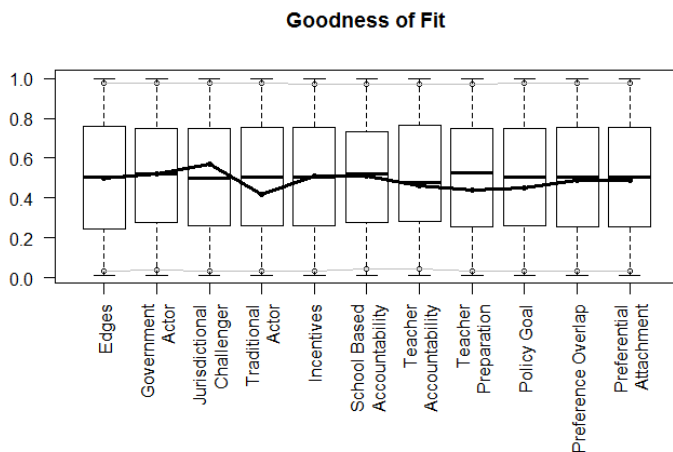


Figure A2: Goodness of Fit for the Policy Window model. The Y-axis is the p-value for the coefficients in the model. A lack of significant p-values indicates good fit.

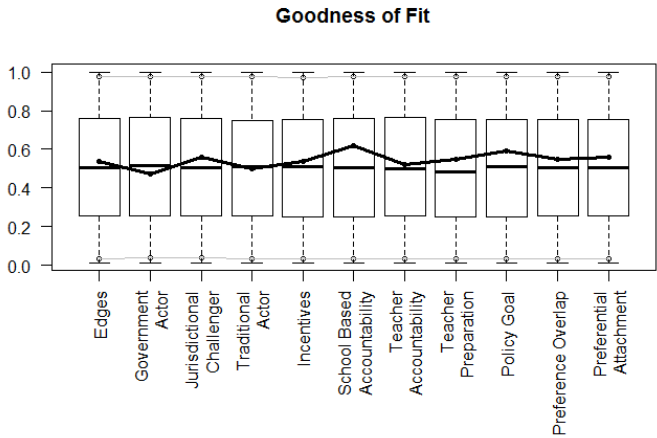


Figure A3: Goodness of Fit for the Obama Administration model. The Y-axis is the p-value for the coefficients in the model. A lack of significant p-values indicates good fit.

References

Hunter, D. R., Goodreau, S. M., and M. S. Handcock. 2008. Goodness of fit of social network models. *Journal of the American Statistical Association* 103(481):248-258.

Levy, Michael A. 2016. "Gwdegree: Improving Interpretation of Geometrically-weighted Degree Estimates in Exponential Random Graph Models." 1(3):doi:10.21105/joss.00036

Morris, Martina. 2015. "GWDegree." Available at: <https://statnet.csde.washington.edu/trac/attachment/wiki/Resources/GWDegree.xlsx> Accessed March 16, 2018

Snijders, Tom AB, et al. 2006. "New specifications for exponential random graph models." *Sociological methodology* 36: 99-153.